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STUDIES ON INDIVIDUAL DIFFERENCES RELATED TO PERFORMANCE ON PROGRAMED INSTRUCTION.

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DESCRIPTORS- *PROGRAMED INSTRUCTION, *GRADE 8, *ACADEMIC ACHIEVEMENT, *GENERAL SCIENCE, CREATIVITY, INTELLIGENCE QUOTIENT, GRADE POINT AVERAGE, READING ABILITY, PROMPTING, *INDIVIDUAL DIFFERENCES, TMI-GROLIER'S COURSE IN GENERAL SCIENCE

THIS STUDY WAS AN EXTENSION OF CRP-2284, WHICH RELATED METHODS OF PROGRAM USE TO LEARNER CHARACTERISTICS. 74 GRADE 8 STUDENTS TOOK A PROGRAMED COURSE IN GENERAL SCIENCE IMPLEMENTED IN 4 WAYS, (1) IN-CLASS STUDY WITH TEACHER-SCHEDULED PROGRESS RATE OR (2) STUDENT-SCHEDULED RATE, AND (3) OUT-OF-CLASS STUDY WITH TEACHER-OR (4) STUDENT-SCHEDULED RATE. THE RELATIONSHIP OF CERTAIN STUDENT TRAITS, I.Q., CREATIVITY, READING ABILITY, AND GRADE AVERAGE TO PERFORMANCE ON THE PROGRAM WAS MEASURED. THE CURRENT STUDY TRIED TO DISCOVER WHETHER PROGRAMED INSTRUCTION PROVIDES ADEQUATELY FOR DIFFERENCES AMONG LEARNERS. IT USED DATA OBTAINED BY THE PREVIOUS STUDY TO INVESTIGATE (1) THE EFFECTIVENESS OF IMMEDIATE KNOWLEDGE OF RESULTS IN EXTINGUISHING WRONG RESPONSES, (2) THE RELATIONSHIP BETWEEN ERROR RATE AND PROMPTING TECHNIQUES, (3) THE INCIDENCE OF BOREDOM SYMPTOMS, AND (4) THE VARIABILITY IN THE FREQUENCY OF BOREDOM SYMPTOMS OVER TIME. OF THESE MEASURES, ONLY NUMBER 2 WAS FOUND TO BE SIGNIFICANTLY RELATED TO LEARNER CHARACTERISTICS. STUDENTS WITH HIGHER LEARNING ABILITIES WORKING OUTSIDE OF CLASS MADE FEWER ERRORS ON FORMAL TYPE PROMPTS. THOSE WITH HIGHER CREATIVITY, WORKING OUTSIDE AT THEIR OWN RATES, MADE FEWER ERRORS ON THEMATIC TYPE PROMPTS. RECOMMENDATIONS AND A BIBLIOGRAPHY ARE PROVIDED. (MS)

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STUDIES OF INDIVIDUAL DIFFERENCES RELATED TO PERFORMANCE ON PROGRAMED INSTRUCTION

Cooperative Research Project No. 3129

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STUDIES ON INDIVIDUAL DIFFERENCES RELATED TO PERFORMANCE ON PROGRAMED INSTRUCTION

Cooperative Research Project No. 3129

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INTRODUCTION

During the late 1950's and the 1960's, it was anticipated by some of its more ardent advocates that programed learning and teaching machines would significantly mitigate the effects of individual differences upon learning. It was hypothesized that small steps and immediate knowledge of results, coupled with self-pacing would absorb the effects of individual differences in learner characteristics, resulting in achievement crowding at the 90 to 100 percent level for most learners.

Subsequent research in programed instruction has not borne out this hypothesis. On the contrary, the research has tended to show that the same positive correlations between the measures of learning ability and subject matter achievement, so evident in "conventional instruction," continue to exist in programed instruction.

This is not to say that the possibilities of more adequately meeting the problem of differences in learner characteristics through programed instruction have been fully investigated. It is reasonable to hypothesize at this time that any utilization of programed instruction must recognize the effects of individual differences. Thus, there is need for further analyses of the relationship between the variability of behavior among learners in programed instruction and differences in learner characteristics.

Problem

This study was an extension of the Cooperative Research Project No. 2284, Methods of Programed Instruction Related to Student Characteristics (Woodruff, Shimabukuro, and Frey, 1965), involving a re-examination of the data in the light of different set of hypotheses. These hypotheses grew out of the original data analysis.

The original study was concerned with (1) the effects of four methods of implementing programed instruction, and (2) the effects of certain learner characteristics on programed instruction. The effects were measured along two dimensions: (1) subject matter achievement over program content, and (2) performance on the program itself. "Performance" was operationally defined as the learner's frame to frame responses.

The four methods studied involved combinations of (a) in-class or out-of-class work on programs, and (b) teacher or student regulated scheduling of discussions and tests.

The individual learner characteristics included the intelligence quotient, creativity measures, the reading ability level, and the past school achievements of the individuals involved.

The study proceeded in terms of four sub-problems. (1) In terms of subject matter achievement, which method brings about the most learning? (2) Is subject matter achievement through programed instruction affected by individual learner characteristics? (3) Is performance on the programed instruction affected by the method of utilization employed? (4) Is performance on the programed instruction affected by individual differences in learner characteristics?

The completed programs from the original study, containing the frame by frame responses of learners, were regarded as records of learner performance on the programed course. In the original study, however, the performance data were examined only in terms of the total number of correct responses, wrong responses, and unanswered frames. The frequencies were then related to measures of learner characteristics.

The present study was proposed because, in the course of making the tabulations of wrong responses and unanswered frames in the original study, several interesting variations were noted among the errors. These variations were typed as follows:

1. There were errors reflecting on the effect of immediate knowledge of results upon learning. Instances where individuals made the same error in a whole series of frames calling for the same response were noted, raising a question regarding the

efficiency of feedback on the extinction of undesired responses.

2. There were errors reflecting on the relative effectiveness of the various prompting techniques employed in linear programs. Noted were responses which could be considered errors for grammatical reasons. This raised a question regarding the effectiveness of syntactical prompts. There was reason also to suspect that the vanishing technique produced a disproportionate number of errors, inasmuch as it gradually increases the amount of writing per frame. Closer examination of the type of prompt used in error frames, it was thought, could reveal other important relationships.

3. Finally, there were numerous instances of careless inattentive work on the programs. These could be designated as symptoms of boredom, i.e., blocks of unanswered frames, use of initials, ditto marks, and illegible scrawling and doodling. The tabulation of these instances of boredom could reveal important insights into the question of motivation in programed instruction.

The purpose of this study was to see whether or not the types of errors noted above were significantly related to differences in learner characteristics. The problem was further delineated into sub-problems as follows:

1. Is there significant variability in the effect of immediate knowledge of results when related to individual differences in learner characteristics?

2. Are there significant differences in the effectiveness of various prompting techniques when related to individual differences in learner characteristics?

3. Are there significant differences in the incidence of boredom symptoms when related to differences in learner characteristics?

4. Is the variation in the rate of boredom symptoms over time significant when related to differences in learner characteristics?

As can be seen from the above sub-problems, this study sought to analyze the variability of behavior among learners in programed instruction in greater detail than is usually done. It was expected that such an investigation would lead to further knowledge regarding a fundamental issue in programed instruction: Does programed instruction provide adequately for individual differences among learners? Another expectation was that the analyses of performance data would demonstrate a need and the techniques, for obtaining field test results other than the usual pre-post test gain scores and error rates, especially where satisfactory randomization of errors is not achieved in field testing. Finally, it was expected that useful knowledge would be gained in adapting the construction and utilization of constructed answer type linear programs(the most numerous type on the market today) to learners with varying characteristics.

Related Research

Individual Differences and Achievement

Although this study is primarily concerned with performance measures, the research relating achievement and individual differences are reviewed here because they bear fundamentally on the problem of individual differences and programed instruction.

No significant correlations between aptitude and achievement in programed instruction were reported by Detambel and Stolurow(1956), Ferster and Sapon(1958), Gange(1962), Coulson(1962), Hough and Revsin(1963), and Williams and Levy(1964). Small negative correlations were found by Porter(1959) and Keislar(1959) between IQ and program effectiveness. Both Meyer(1960) and Feldhusen and Eigen(1963) found that reading level as a measure of learning ability did not account for much of the learning in programed instruction. Further, Brown(1962) was moved to suggest, in the light of comparisons of achievement between groups using programed materials and groups using "conventional" materials, that similar levels of achievement could be expected from learners of varying abilities through programed instruction. Glaser and Reynolds(1962) strongly implied in their study on the relative effectiveness of three methods that intelligence and past achievement measures may not be predictive of amount of learning resulting from linear programed sequences.

However, other studies have tended to confirm the positive relationship between learning ability and achievement. A host of studies were reported at about the same time which bore out this relationship. Among these were Bean's(1962) study involving rote and conceptual forms of programs; Hatch and Flint's(1962) study which evaluated academic intelligence measures as predictors of subject matter achievement in both programed and "conventional" teaching; and the study by Lambert (1962) which reported that IQ is the most significant variable in immediate subject matter acquisition through programed instruction. Reed and Hayman(1962) reported that high-ability learners did better on programed rather than "conventional" instruction, while low-ability students did better in "conventional" rather than programed instruction. Higher retention scores on two retest intervals(2 and 30 weeks) were reported for more intelligent students than less intelligent students by Alter(1962).

In summary, programed instruction research relating individual differences in learning ability and achievement have produced conflicting results. Generally, the earlier studies(prior to 1962) tended to negate the positive relationship between differences in learning ability and subject matter achievement. Later studies(since 1962) have tended to demonstrate that the standard predictors of academic success--intelligence quotients, grade point averages, and reading ability--are also good predictors of success through programed instruction. If the early advocates had grounds for anticipating that the problem of individual differences could be largely solved through programed instruction, subsequent research has provided ample grounds for asserting that, if such exists in fact, it is still very much an unrealized potential.

Individual Differences and Performance

This study was devoted to the detailed analysis of learner performance on programed instruction. The nature of the learners' frame be frame responses in a course length linear program was related to certain measures of individual differences in learner characteristics.

Learning Ability. The standardized measures of learning ability utilized in this study were the intelligence quotient and reading ability. Included also was past achievement measures in the form of over-all average and average grade in science.

The literature reviewed tended to bear out a negative relationship between error rate in programed instruction and learning ability. For example, Hatch and Flint(1962) found significant intercorrelations among error rate, criterion test performance, and intelligence.

A three part study conducted by Woodruff, Faltz, and Wagner(1966) also reported significant relationships between performance and learning ability. In part one of the study, it was found that the "Fast," "Average," and "Slow" learner groups (1) completed the programs in the order of their learning ability, and (2) had average number of correct responses in the order of their learning ability. In part two of the study, the number of correct responses produced in a spelling program were compared between matched pairs. Each pair consisted of a learner from a high reading level group, and a learner from a low reading level group. Of the thirty comparisons made, only one failed to show a markedly higher number of correct responses in favor of learners from the high reading group. Part three of the study involved personality measures and is cited later.

The findings of the original study(Woodruff, Shimabukuro, & Frey, 1965), of which this study was an extension, related performance to learning ability. Its findings are herewith summarized.

> When one looks at the correlations between the more traditional educational measures of individual differences(i.e., reading and intelligence measures and past school records), one begins to see the more common relationships with performance. When the data for all the groups are combined there are significant correlations among practically all of the variables. This would indicate that these individual differences brought into the situation by the learners do affect the way they work on programed learning...
>
> When the groups are compared on these significant correlations, it is readily apparent that Groups III and IV, the ones under less direct supervision since they worked on their programs out-of-class, showed more of the influences of individual differences. Group I had no significant correlations

between these variables and Group II had the next least number. Group III had significant correlations between all of them and Group IV had them among all but the second semester performance correlations. [see page 23 for a description of the treatment groups] This indicates that the more the student is on his own, the more the commonly found effects of individual differences in the classroom will show up in programed learning, if his frame-by-frame behavior is being evaluated.

...The consistent finding that both the speed and comprehension scores in the reading test used in this study are valid predictors of both performance and achievement suggests that special attention should be paid to the reading ability of students who are to be assigned to or who seek enrollment in a programed course. The highly significant correlations between reading and achievement and performance for the year provide additional evidence of the importance of good reading speed and comprehension. The rather high regression coefficients after the common variance with intelligence had been partialed out of reading comprehension and the total Gates score further emphasize this. Therefore, it would seem inadvisable to schedule those students who have demonstrated below average reading ability into courses which use programed instruction. On the other hand, of course, one should not hesitate in permitting good readers to enroll in such courses, should they so desire. It would, in fact, seem that as a method of instruction, programed instruction would allow these students to utilize their reading skills to optimum advantage in the process learning.

The consistency of contribution of the nonverbal I.Q. score as a predictor of both performance and achievement cannot be ignored in assigning students to programed instruction. Even when the common variances with other predictors are partialled out, it still had a regression coefficient of .40 with year's achievement. In view of this it would seem that information of the type provided by a non-verbal intelligence battery would give some additional insight into the probable performance and achievement of a student in a programed course...

The research reviewed above leaves little doubt that performance of learners in programed instruction, whether measured as error rates or as number of correct responses, is determined largely by learning ability(i.e., I.Q., reading ability, and past school achievement).

Creativity. Except for the original study(Woodruff, Shimabukuro, & Frey, 1965), there seems to be a dearth of studies relating creativity to performance in programed instruction. However, it was deemed useful to cite here studies relating programed instruction to other personality variables.

Traweek(1964) found that fourth graders who were "successful" achievers in programed instruction in fractions indicated tendencies to more withdrawal, less self-reliance, and more signs of test anxiety, than did unsuccessful ones. Schoer(1966) identified 36 Ss who generated reactive inhibitions(RI) quickly and 36 Ss who generated RI slowly. He found that Ss who generated RI slowly made significantly more errors than those who generated RI quickly. Knight and Sarsenrath(1966) administered a quasi-projective measure of achievement imagery, a test anxiety questionnaire, and an achievement pretest to 139 college undergraduates. These measures were related to three criteria: (1) time needed to complete a programed material; (2) error rate on the program, and (3) test of retention. The high achievement motivated students scored better on all three criteria than low achievement motivated students. High test anxiety students worked faster and made fewer errors than low anxiety students but failed to exhibit higher retention scores. Lublin(1965) found that Ss with lower scores on "Autonomy-need"(Edwards Personal Preference Schedule) made higher scores on a criterion test than did Ss with high "Autonomy-need" scores.

In part three of the study by Woodruff, Faltz, and Wagner(1966) three measures of personality were taken for 26 nineth graders who worked on a program on Biology. The measures taken were the Edwards Personal Preference Schedule(EPPS), the Gordon Personality Inventory(GPS), and the James Internal-External Scale(JIES). From the EPPS, only the need to achieve had a significant relationship to performance(number of correct responses). All five of the GPC measures were significantly related to performance, whereas none of the JIES measures were found to be significant. These relationships could not be regarded as definitive, inasmuch as the program utilized was relatively short. They did, however, indicate functional relationships between performance and the personality characteristics of learners.

In the study by Woodruff, Shimabukuro, and Frey(1965), only a few scattered significant relationships were found between the Torrence creativity measures and performance (number of correct responses). In the treatment group that worked in unsupervised out-of-class situations, however, there were 16 significant correlations, mostly involving the Consequences and Improvements tests. It was cautiously speculated that the more creative students would do better at working on programed instruction than a less creative student when the student takes the larger responsibility of getting the work done.

A consistent pattern of personality variables is far from discernable from the research reviewed above. Performance has been found to relate to self-reliance and test anxiety, to reactive inhibitions, to achievement imagery, to autonomy-need, need to achieve, and to certain of the Torrence creativity measures. Large gaps still exist in the research, and much more will need to be done before the studies could be knitted into a coherent theory relating programed instruction with individual differences in personality characteristics.

Boredom, Prompting, and Knowledge of Results. The present study attempted to relate individual differences in learner characteristics to behaviors in programed instruction classified as (1) boredom symptoms, (2) prompting technique utilized in high error rate frames, and (3) repetitive errors(see Chapter II for description of each category). The literature relating to boredom, prompting, and reinforcement is, therefore, cited below.

Boredom. Boredom among learners in programed instruction has been reported by many users. Gotkin(1963) claimed that this is the most commonly stated complaint of students who have used programs. Thelan and Ginther (1964) reported that their survey showed that both low and high ability learners find programed instruction boring, especially long programs. Houston(1962) suggested a series of techniques for combating boredom. Among these were (1) using of branching; (2) combinations of Skinner and Crowder methods; (3) some programed adaptations of group instruction, and (4) breaking up of long programs into subunits. Mager(1961), in a study in which learners were permitted to control their own sequencing of instruction, suggested that motivation for, and satisfaction from, learning were directly related to the amount of control the learner himself has on the instruction. He offered this as a possible explanation for the fact that linear programs are usually considered dull.

Closely associated with the problem of boredom is the attitude of learners toward programed instruction. Van Atta(1961) reported that surveys of student reaction to programed instruction indicated that amount of repetition and too short steps may be causes of boredom. Banta(1963) confirmed Van Atta's findings. He went further and compared student reaction toward a programed and non-programed text in psychology. The non-programed text was rated more "interesting," and more "good," but not more "fair" than the programed text. The programed text was judged to be lacking in depth in comparison to the non-programed text. Goldberg, Dawson, and Barrett(1964) reported that beginning level clerical trainees found programed instruction resulting in declining interest while instruction through conventional methods produced rising interest levels. Randolph(1964) found that higher ability eighth graders thought a program on sets, relations, and functions was boring inspite of the fact that effective learning was observed among them, and they found the content of the program interesting. Lindvall(1964), on the other hand, reported that first and fourth graders working on programed texts were observed to be more attentive than their counterparts using non-programed materials. He found that attitude measures were not seen to relate significantly to observed attention-inattention nor to amount learned.

The research herewith reviewed seems to indicate that boredom among learners probably occurs more frequently in programed instruction than in the more accustomed methods of instruction, i.e., conventional methods. To the extent that causes have been speculated about, they seem to involve the basic characteristics of the usual Skinnerian linear program, e.g. short steps, repetition. The research, however, is devoid of attempts to identify types of learners who find programed instruction more or less boring, especially in terms of differences in learner characteristics. There also is the possibility that boredom in programed instruction, as with other methods of instruction, is more a problem of how and under what circumstances programs are used than it is an inherent attribute of programed instruction.

Prompting. So far as the researchers have been able to determine, no analyses of error relating type of prompting used to learner characteristics has yet been made. There was an article, however, by Gotkin(1964) which noted that socially disadvantaged learners are not able to take advantage of syntactical cues, nor are they able to relate responses made in previous frames to the requirements of subsequent frames. In this article, Gotkin argues that providing for individual differences in programed instruction is more a matter of matching cognitive styles between programs and learners, rather than an adjustment in terms of branching and size of step.

The literature also revealed several studies on the relative effectiveness of various prompting techniques. Israel(1960), for example, found that, varying the physical clarity of prompts, successively smaller amounts of prompting were required to attain correct responses. Hershberger(1964) found that typographical cueing (highlighting the type used for essential lesson content), failed to enhance the effectiveness of programs in history and science. Hershberger and Terry(1965) found that typographical differentiation of core content from enrichment content in conventional texts enhances learning, and that typographical cueing in programed texts and programed quizzing have independent and additive effects on learning. Campbell(1961) found small, non-significant differences in the effectiveness of two versions of a program: one in which responses were fully prompted, and the other utilizing indirect and less obvious prompting. Angell and Lumsdaine(1962) found that a program using vanishing resulted in significantly higher delayed retention scores than did a program in which prompts were kept at full strength throughout.

Knowledge of Results. Earlier studies have tended to show that learning is enhanced with knowledge of results. These studies involved the use of Pressey type tests(Angell, 1949), and instructional films (Michael and Maccoby, 1953), as well as programed instruction(Meyer, 1960). They also include experiments with different techniques for providing knowledge of results(Bryan, Rigney, and Van Horne, 1957).

Several of the more recent studies on knowledge of results, however, have reported no significant differences (Feldhusen, and Birt, 1962; Hough, and Revsin, 1963; and McDonald and Allen, 1962). Further, More and Smith(1962) found no significant differences when the method of informing students as to whether their responses were right or wrong was varied.

The more recent studies, however, are not unanimous in negating the effect of immediate knowledge of results. Ripple(1963), for example, found that reinforced programed instruction was significantly more effective than the lecture, but that non-reinforced programed instruction was no better than the lecture. Further, it was found that reinforced programs produced an increase of 7 to 16 percent in learning efficiency over simply reading a text on the same content. Likewise, Lublin(1965) confirmed the need for knowledge of results in programed instruction. Her investigation of fixed and variable ratio reinforcement resulted in better learning among the groups receiving reinforcement than the control group which received no reinforcement. In addition, it was found that variable ratio reinforcement was more effective than fixed ratio reinforcement.

Furthermore, Melaragno(1960) reported that "massed negative" reinforcement depressed learning while spaced negative reinforcement had no depressing effect. Moore, and Smith(1962) found no significant differences among five types of immediate reinforcement. However, in a later study, Moore and Smith(1964) found that knowledge of results which also displayed the correct response resulted in lower error rates than simple knowledge of "right" or "wrong." This result confirmed the result obtained by Keurst(1964) who reported that "explanatory" reinforcement is superior to "non-explanatory" reinforcement.

Summary.

The literature reviewed above is summarized as follows:

1. Programed instruction research relating individual differences in learning ability and achievement have produced conflicting results. Generally, the earlier studies (roughly from 1956 to 1962) tended to negate the positive relationship between differences in learning ability and subject matter achievement. Later studies(since 1962) have tended to demonstrate that the standard predictors of academic success--are also good predictors of success through instruction.

2. The research leaves little doubt that performance

of learners in programed instruction, whether measured as error rates or as number of correct responses, is determined largely by learning ability(i.e., I.Q., reading ability, and past school achievement).

3. The various measures of personality, when related to subject matter achievement, error rates, number of correct responses and rate of program completion, reveals that the personality make-up of learners is a significant factor in the effectiveness of programed instruction.

4. Boredom is a common complaint among learners under the conditions of programed instruction. Small steps, seeming repetitiveness, and the high degree of control over the learner in linear programs seem to be causal factors. Overcoming boredom is largely a matter (1) of improving programing techniques generally, (2) better adaptation to differences in learner characteristics, and (3) of better adaptation to differences in learner characteristics in the way programs are utilized.

5. Prompting correct responses is seen as an important characteristic of programed instruction. Such techniques as vanishing and typographical cueing seem to have particular advantages. The research, however, on which prompting technique or method works well or poorly on various types of learners is negligible, if not totally

absent.

6. The efficacy of immediate knowledge of results is inconclusive. Almost as many studies deny as confirm the significance of the contribution immediate knowledge of results makes on learning from programed instruction. With the exception of knowledge of results accompanied by explanatory material, the various reinforcement methods and schedules have no particular advantages. The research is devoid of studies relating knowledge of results and type of content or type of learners. Nor have any studies been conducted which relate methods of reinforcement with learner characteristics.

Conclusion.

The above review of research indicates clearly that there are many unanswered questions regarding programed instruction and individual differences in learner characteristics. Aside from studies which determined the effectiveness of existing programs among the various learner types and learner groups, the area of individual differences has been almost totally neglected.

Gross studies designed to compare the effects of programing techniques, including variations in prompting, reinforcement, step size, presentation variables, etc. are no longer needed. The need is for detailed analyses of where, when, with what kind of learners, with what kind of content and under what learning conditions is this or that programing methodology effective. The need, in short, is for studies which make strides toward the development of a programing technology capable of producing programs more closely adapted to the characteristics of learners.

PROCEDURES

The Original Study

Inasmuch as this study was an extension of an earlier study(Woodruff, Shimabukuro, & Frey, 1965), a summary of the procedures utilized in that study is given below.

Subjects. The Ss for this study were 80 eighth grade students of the public schools in Sandwich, Illinois who were enrolled in the year-long general science course. For a variety of reasons the final N was reduced to 74.

Treatment. The Ss were divided into four treatment groups. The treatments were varied along two dimensions: (1) in-class or out-of-class use of the programs; and (2) teacher or student regulated scheduling of the rate of progress through the program, discussions, and tests. Thus Groups I and II were in-class groups, and Groups III and IV were out-of-class groups. Also Groups I and III worked on student(individually) regulated schedules, and Groups II and IV worked on teacher regulated schedules.

The programed instruction used was TMI-Grolier's complete course in General Science(Course TM-401). This course was divided into two approximately equal sections with students required to complete one section each semester of the school year.

Data gathered. Achievement measures were taken through the administration of a criterion test at the beginning of the school year(pretest), at the end of the first semester(posttest I), and at the end of the second semester(posttest II).

Performance measures were frequencies of different kinds of frame to frame responses made by the Ss in their programs. These were typed as "correct," "incorrect," or "blank(no response)."

The performance and achievement measures were the dependent variables of the study. The independent variables were the measures of learner characteristics, along with the methods of utilization. The measures of learner characteristics were: (1) Intelligence quotient(Lorge-Thorndike, Level 4, Form A, Verbal and Non-verbal); (2) Creativity(Torrence, Creative Thinking Tasks, Form DKC); (3) Reading Ability Level(Gates Reading Survey, Form M1); (4) Over-all Grade Average, 6th and 7th grades.

The Current Study

This study utilized the above data to test new hypotheses which grew out of the initial data analyses. In essence it consisted of the re-examination of the completed programs for the purpose of tabulating frequencies of particular types of responses. It did not involve new Ss nor the collection of new raw data. The following measures were obtained from a re-examination of the programs:

1. Repeated errors. This measure was the number of instances where the same wrong responses were given two times or more to a series of frames calling for a particular response.

In order to take this measure, the entire program was examined to locate sections in which the same response was requested two times or more within an interval of less than 12 frames(about three pages). The sections so identified were examined for each S, and the instances where the same wrong answers were repeated were tabulated. Thus was obtained for each subject the total number of times he constructed the same wrong response even though he was informed the first time that he was wrong.

2. Prompting technique. The type of prompting technique utilized in frames were particularly high error rates(14 or more or approximately 19% error rate) was determined.

An error count for each frame in the programed course was determined from the performance tabulation sheets of the original study(sheets listing the frames missed by each S). Each frame having an error rate of 14 or more was examined to determine the type of prompting technique employed in it.

The prompting techniques were categorized as follows (as classified in Taber, Glaser, and Schaefer, 1965):

a. Formal Prompts.

1. Partial response prompts. A part of the desired response offered as a prompt is the classic example of a formal prompt....Sometimes only the first word of a forgotten poem is enough to cue an entire line or stanza....In the same way, a frame of desired word eliminates many possible answers and at the same time keeps the frame simple. [For example,]

   "Part of the word is like part of the word manual. Both parts come from an old word for hand. Many things used to be made by hand. _ _ _ _facture"

2. Rhyming prompts. Prompts of this type provide the student with a word which rhymes with the response. The rhyming prompt is a formal prompt in the same sense that the partial response is: in order to rhyme with the desired response it must give away at least part of the formal structure of the response. [For example,]

   "9 times 7 and just 1 more, is 8 times 8 or __."

3. Literal prompts. Often a single response may occur in the presence of several appropriate stimuli. For example, both the figure "3" and the word "three" evoke the same spoken response, as do both the symbol "$" and the word "dollar." Whenever the student has been taught to respond correctly to one of several stimuli which call for the same response, his previous learning may be used to extend the response to the unlearned stimuli.

4. Frame structure prompts. Frequently the physical arrangement of a frame can be used to prompt the learner's response. The location of the response blank, for example, can serve to prompt the type of response desired and minimize the occurrence of alternative responses. [For example,]

   "Five millimeters would usually be written as: 5 _____."

   ...Another example of a structural prompt is the length of the response line...Like the physical arrangement of the response blank, minor details of typography and format can play a_role in prompting the student's response. [For example,]

"Greece is a peninsula in the Mediterranean Sea. Florida is a _________ in the Atlantic Ocean."

...Underlining is another structural detail that may have prompting value. Any word in the body of a frame that is to serve as a prompt for the response may be further emphasized by underlining....

b. Thematic Prompts.

1. Pictures as thematic prompts. This type of prompt is introduced first because it may be used as either a formal or thematic cue. A picture may be cued to suggest answers, or label attached to the picture may serve a prompting function.

2. Context-setting. When an instructor asks a class, "How is this principle applied in the design of turbin engines?" he is suggesting or setting a context which will evoke student discourse relevant to engine design and not flower arrangement or meteorology. By indicating the topic of conversation, a host of relevant responses assume high strength while other behaviors which are pertinent to other conversations are reduced in immediate strength. In the same way, a frame can be labeled to suggest its context and consequently to limit the range of possible answers. [For example,]

   "HEARING"

   The brain "makes sense" out of the impulses carried from the cochlea by the _______nerve."

3. Grammatical structure. If a person begins an utterance with the pronoun "we," he immediately determines the form of the subsequent verb since his audience typically reinforces correct grammar. Similarly, "this" and "these" are likely to be followed by appropriate singular and plural

forms...Thus, the grammar used in a frame can restrict the possible answers to that frame. Using a specific article, like "a" or "an" rather then nonspecific "a(n)" limits the number of responses the student can make without violating customary grammar.

4. Synonyms and antonyms. Synonyms and antonyms may be used to limit the response range by prompting like and opposite responses. [For example,]

   "Learning usually occurs when an individual's response is promptly rewarded or ____________."

5. Analogy. Analogies frequently serve to bring together aspects of a subject matter as well as providing strong prompts. The method of using such prompts is often to present one or more complete analogies in the text of a frame followed by an incomplete analogy to which the student responds. [For example,]

   "It is easy to learn about the Metric System when one thinks of the money system in relation to it. A dollar has ___cents(pennies).

   A dollar has 100 cents. A meter has ___centimeters."

6. Rules. Response tendencies may be set up in a frame by stating a general subject matter rule. Frequently, such frames present the statement of a rule, followed by an incomplete example of the rule which the student must complete. Rules may also be used to prompt other similar rules. The intention in using a rule as a prompt is not to teach the rule; this may have already been done or may be in process. Rather, the rule is presented as a cueing device....[For example,]

   "The greatest amount of contrast is presented by complementary colors. Green would stand out best on a _______ background."

7. Examples. ...an example or particular instance may be used to prompt the completion of a related example or rule. An example used as a prompt may be called an inductive frame, that

> is, it leads from instance to the general case. In general, a rule may be used to prompt either other rules or examples, while an example may be used to prompt the completion of other examples or the rule which it exemplifies. [For example,]

> "During extinction, rats often return to behaviors that were reinforced prior to recent conditioning. Humans, when reinforcment is withheld, may show behavior that has not been reinforced since childhood. Both cases illustrate the principle of ________________."

Frequencies were tabulated for each S according to the type of prompting technique used in the frames he missed. The tabulation included only those frames missed which were earlier identified as high error frames.

In addition, a frequency tabulation was made of the high error frames falling in each prompting category.

3. Boredom symptoms. Boredom symptoms were operationally defined as any attempt to shorten responses, that is, the use of ditto marks, initials, omitting words in multiple word responses, circled answers within frames, circled answers and lines drawn to response blank, writing responses less than the required number of times. In addition, deteriorating handwriting(handwriting quality dropping noticeably), blocks of 5 frames omitted in succession, and doodles were considered as boredom symptoms. Frequency tabulations were made of the instances when such symptoms appeared on each S's program.

The sub-problems, together with the data associated with each, are restated below.

1. Is there significant variability in the effect of immediate knowledge of results when related to individual differences in learner characteristics? The data associated with this problem were the frequencies of repeated errors (feedback failures) tabulated for each S.

2. Are there significant differences in the effectiveness of various prompting techniques when related to individual differences in learner characteristics? The data used here were the frequencies of prompting technique utilized in the high error frames missed by each S.

3. Are there significant differences in the incidence of boredom symptoms when related to differences in learner characteristics?

4. Is the variation in the rate of boredom symptoms over time significant when related to differences in learner characteristics? The frequencies tabulated for each S in units located at five different points in the programed course were utilized in this analysis.

RESULTS

I. The first sub-problem investigated was the following:

> Is there significant variability in the effect of immediate knowledge of results when related to individual differences in learner characteristics?

The basic data here were the number of repeated wrong responses given two or more times within twelve frames in a series calling for the same response. They included either responses of the wrong word(or symbol) or words that were misspelled. These measures were looked at individually and combined.

Table 1 presents the mean number and standard deviations for each of the measures of repeated errors. The mean number and range of these errors were so small that any correlational analysis would be meaningless. So, it was decided to examine further the learner characteristics of the Ss who made a number of repeat errors approximately one standard deviation above the mean number of errors. Table 1 also presents these figures. It was recognized that this still gave an error score that was quite small, but might give a basis for some hypothesizing of possible relationships of learner characteristics and the effects of knowledge of results. The rationale was that if knowledge of results were relatively ineffective for certain learners, they would have a greater number of repeat errors. Those Ss studied had the following number of repeated errors: (a) wrong responses, 8, 10, 11, 12, 12, 19, 20; (b) wrong spelling, 4, 5, 8, 10, 11, 12; and (c) combined errors, 10, 11, 11, 12, 12, 12, 14, 15, 18, 19, 20. The examination of these Ss in an attempt to see if they tended to follow a particular pattern of measured learner characteristics showed that they were distributed all along the continuum being investigated.

II. The second sub-problem studied was:

> Are there significant differences in the effectiveness of various prompting techniques when related to individual differences in learner characteristics?

To study this only "high error" frames were used, these being operationally defined as those on which at least 20 percent of the Ss made errors of some kind. There was a total of 587 high error frames in the program of 7,052 frames. These high error frames were then divided into those using formal prompting and thematic prompting techniques, according to the criteria stated earlier. There were 142 using formal prompts and 445 using thematic prompts. The number of errors made by the Ss on the high error frames using formal prompts were correlated with the learner characteristics and a similar correlation was run using the high error frames using thematic prompts.

Table 1

Repeated Errors:

Mean Number and Standard Deviations

Each Type

(N = 74)

	Type of Errors		
	Wrong Responses	Spelling	Combined
Mean no. of errors	3.32	1.00	4.32
Standard deviation	4.16	2.52	4.96
No. errors needed by S for special study	7	4	9
No. Ss meeting the criterion	7	6	11

Table 2 presents the resulting correlations for the creativity measures, showing them for the total group of Ss and for those within each instructional group. These latter were included because one of the groups(Group III) shows the only statistically significant correlations. Further, a study of these, plus the other correlations presented for the group give an interesting pattern. Group III worked through their programs outside of class at their own rates of progress, thus, giving them the greatest amount of freedom.

There are no significant correlations for the total of the groups or for Groups I, II, or IV. However, Group III shows statistically significant correlations(at $P < .05$ or $< .01$ levels) for five creativity measures and the number of errors on formal prompt frames, and eight creativity measures and the number of errors made on thematic prompt frames. The creativity measures that were statistically significant in their correlations with the number of errors made on "high error frames" using formal prompt techniques were Improvements, originality($r = -.51$; $P < .05$), Improvements, total($r = -.56$; $P < .01$), Consequences 1, fluency($r = -.57$; $P < .05$), Consequences 1, originality ($r = -.72$; $P < .01$), and Consequences 1, total($r = -.70$, $P < .01$). The ones that were significantly related to number of errors in "high error frames" using the thematic

Table 2

Creativity Measures Correlated with
Kind of Prompt Used in
High Error Frames

(N = 74)

Learner Characteristic	Group 1		Group 2		Group 3		Group 4		(N = 74) Total	
	Formal Prompt	Thematic Prompt	F	Th	F	Th	F	Th	F	Th
Circles, Fluency	-.34	-.10	-.04	-.08	-.02	-.09	-.01	-.00	-.07	-.07
" , Flexibility	-.26	-.04	.01	-.02	-.18	-.34	-.19	-.02	-.17	-.13
" , Originality	-.27	-.04	-.00	.02	-.12	-.27	-.40	-.25	-.18	-.13
" , Elaboration	-.34	-.16	-.04	-.06	-.09	-.18	-.41	-.21	-.08	-.05
" , Total	-.41	-.13	-.04	-.06	-.12	-.24	-.31	-.15	-.14	-.11
Improvements, Fluency	-.09	.06	.13	.19	-.48	-.60*	-.03	-.13	-.09	-.07
" , Flexibility	.02	.11	-.02	.03	-.39	-.51*	-.32	-.37	-.17	-.15
" , Originality	-.11	.00	.11	.26	-.51*	-.58*	.00	-.22	-.11	-.12
" , Elaboration	.00	-.21	.32	.29	-.03	.11	-.11	.00	.12	.15
" , Total	-.08	.03	.20	.29	-.56*	-.64+	-.08	-.23	-.09	-.08

^{+}p .01
$^{*}p$ .05

Table 2(continued)

Learner Characteristic	Group 1 Formal Prompt	Group 1 Thematic Prompt	Group 2 F	Group 2 Th	Group 3 F	Group 3 Th	Group 4 F	Group 4 Th	(N = 74) Total F	(N = 74) Total Th
Tin Cans, Fluency	-.19	.01	.14	.25	-.14	-.33	.06	.15	-.01	-.01
" , Flexibility	-.09	.05	.00	.19	.03	-.12	.40	.14	.04	.04
" , Originality	.10	.15	.05	.17	-.10	-.27	.26	.30	.04	.03
" , Elaboration	-.22	-.33	-.02	.09	-.43	-.31	-.10	.19	-.20	-.06
" , Total	-.07	.07	.08	.23	-.16	-.32	.22	.34	.00	.04
Consequences 1, Fluency	-.11	.08	.03	.26	$-.57^{*}$	$-.68^{*}$	-.09	.01	-.20	-.11
" , Originality	-.05	.08	.30	.34	$-.72^{+}$	$-.81^{+}$	.00	-.07	-.15	-.11
" , Total	-.07	.08	.07	.09	$-.70^{+}$	$-.80^{+}$	-.21	-.18	-.02	.00
Consequences 2, Fluency	-.24	-.02	-.05	.09	-.39	$-.52^{*}$	.08	.03	-.12	-.07
" , Originality	-.12	.12	.05	.17	.12	.07	-.07	-.22	.01	.03
" , Total	-.20	.07	.02	.17	-.04	-.13	-.10	-.26	-.07	-.04

^{+}p .01

$^{*}p$ .05

prompt techniques were Improvements, fluency($r = -.60$; $P < .05$), Improvements, flexibility($r = -.51$; $P < .05$), Improvements, originality($r = -.58$; $P < .05$), Improvements, total($r = -.64$; $P < .01$), Consequences 1, fluency ($r = -.68$; $P < .01$), Consequences 1, originality($r = -.81$; $P < .01$), Consequences 1, total($r = -.80$; $P < .01$), and Consequences 2, fluency($r = -.52$; $P < .05$).

A further examination of these correlation coefficients between creativity measures and errors on frames for the Group III indicates that there is a consistent pattern showing that there is a larger degree of negative relationship between the errors made on thematic prompt frames and creativity measures than in the case of formal prompt frames. The only exceptions among the 21 creativity measures are (a) Tin cans, elaboration where the r is $-.43$ with formal prompt frames and $-.31$ with thematic prompt frames and (b) Consequences 2, originality where the r is $.12$ with formal prompt frames and $.07$ with thematic prompt frames. Although there is this consistency, in only four measures are there statistically significant differences found between the r's. With a $t = 2.01$ necessary for a $p = .05$, the following t-scores were found: Consequences 1, fluency, $t = 2.14$; originality, $t = 2.13$; total, $t = 2.43$; and Consequences 2, fluency, $t = 2.22$. Further, it can be seen that this group(working outside of class at their own rates) is the only one that gives a consistent direction of relationship between errors, regardless of whether they are made on formal or thematic prompt frames. All r's are in the negative direction, except three. All of the other groups show both the positive and negative relationships.

Table 3 presents the correlations between ability measures and the number of errors made on "high error frames" for both those using formal and thematic prompt techniques. These correlations are given for the four groups as well as for the total. The total group had all correlations statistically significant with all but one being at the $P < .01$ level. Group I had no statistically significant correlations and Group II had six; grade averages, all subjects, with formal prompt frames; Gates reading, speed with each prompting techniques; Intelligence, non-verbal raw score with each prompting technique; and Intelligence, non-verbal I.Q. with formal prompt frames. All of these were at the $P < .05$ level. All of Group III correlations were statistically significant, 14 at the $P < .01$ level and the other six at $P < .05$. All but one of the Group IV correlations were statistically significant, with seven at the $P < .01$ level and 12 at $P < .05$. Both of these groups worked their programs outside of the

Table 3

Ability Measures Correlated with Kind of Prompt Used in High Error Frames

(N = 74)

	Group 1		Group 2		Group 3		Group 4		Total	
Learner Characteristic	Formal Prompt	Thematic Prompt	F	Th	F	Th	F	Th	F	Th
Grade Average(all subjects)	.22	.41	$-.42^*$	$-.29$	$-.61^*$	$-.57^*$	$-.78^+$	$-.70^+$	$-.47^+$	$-.34^+$
Grade Average(science)	.19	.33	$-.39$	$-.27$	$-.52^*$	$-.53^*$	$-.74^+$	$-.55^*$	$-.41^+$	$-.28^*$
Gates Reading, Speed	-.12	.17	$-.48^*$	$-.42^*$	$-.81^+$	$-.70^+$	$-.47^*$	$-.49^*$	$-.54^+$	$-.44^+$
" " , Vocabulary	-.22	-.01	$-.31$	$.28$	$-.58^*$	$-.50^*$	$-.52^*$	$-.51^*$	$-.44^+$	$-.36^+$
" " , Comprehension	.10	.36	$-.38$	$-.24$	$-.72^+$	$-.67^+$	$-.58^*$	$-.50^*$	$-.47^+$	$-.33^+$
" " , Total	-.17	.04	$-.04$	$-.10$	$-.72^+$	$-.63^+$	$-.53^*$	$-.48^*$	$-.39^+$	$-.31^+$
Intelligence, Verbal R.S.	.11	.36	$-.33$	$-.24$	$-.73^+$	$-.65^+$	$-.64^+$	$-.58^*$	$-.44^+$	$-.32^+$
" , Verbal I.Q.	.12	.37	$-.32$	$-.25$	$-.74^+$	$-.66^+$	$-.66^+$	$-.54^*$	$-.47^+$	$-.34^+$
" , Non-verbal R.S.	.25	.40	$-.49^*$	$-.41^*$	$-.71^+$	$-.69^+$	$-.67^+$	$-.55^*$	$-.41^+$	$-.33^+$
" , Non-verbal I.Q.	.25	.41	$-.48^*$	$-.38$	$-.86^+$	$-.80^+$	$-.64^+$	$-.45$	$-.47^+$	$-.35^+$

^+p .01
$^*p$ .05

classroom, whereas, the other two groups worked theirs in the class.

A further examination of the r's for the total group show that the relationship between the number of errors and formal prompt frames are greater than with the thematic prompt frames. Also, these differences are statistically significant for each measure(t-scores ranging from 2.05 to 2.90, with 2.01 needed for $p = .05$), except in the cases of Gates, vocabulary; Gates, total; and Lorge-Thorndike, non-verbal, raw score. Looking at Groups III and IV, the ones which contributed the most to the statistical significance of the r's for the Total Group, one finds the greater negative relationship between the ability measures and formal prompt frames, with one exception for each group. Only one of these differences was statistically significant: Group III; Gates, speed; $t = 2.71$, $p < .05$.

III. The third sub-problem was:

> Are there significant differences in the incidence of boredom symptoms when related to differences in learner characteristics?

The basic data used for this measure were incidents of abbreviated responses, such as, ditto marks, initials, omitting words, circling answers, etc. In addition, deterioration of handwriting and doodling were included.

Table 4

Boredom Symptoms: Mean Number and Standard Deviation of Each Type

	Kinds of Boredom Symptom				
	Shortened Response	Deteriorating Handwriting	Omitted Frames	Doodles	Combined Symptoms
Mean	17.85	10.80	9.70	1.38	40.68
Standard Deviation	45.91	28.03	25.44	3.47	72.32
No. of symptoms needed by S for special study	63	38	35	5	113
No. of Ss meeting the criterion	5	9	5	9	6

As in the case of repeated errors, the incidence of these were small enough that a correlational analysis was meaningless. Table 4 presents the mean number of incidents and the standard deviation. The same approach was used here as in the study of repeated errors. Because of the small number of incidents, any break-down into categories could not be made, so, only the total number of incidents was used. Since the correlational analysis was impossible, the Ss who were at least one standard deviation above the mean were considered for any indications of learner characteristics that might be related to boredom symptoms. As in the examination of repeated errors, no pattern became apparent, since the involved Ss were found all along the particular dimensions considered. However, 5 of the 6 of the high-boredom group worked their programs in an in-class situation where they had little option about when they would be doing their work.

The lack of any significant findings on the third sub-problem made the investigation of the fourth one unnecessary.

DISCUSSION OF RESULTS

This study investigated the (a) effectiveness of immediate knowledge of results in extinguishing wrong responses; (b) the relationship between error rate and prompting techniques; (c) the incidence of boredom symptoms, and (d) the variability in the frequency of boredom symptoms over time. These investigations were made especially with reference to differences in learner characteristics.

Knowledge of Results

The mean number of repeated errors for the 74 Ss was 4.32 which gave the extremely low mean rate of repeated errors of .0006 percent(based on 7052 frames in the programed course). In the original study(Woodruff, Shimabukuro, & Frey, 1965) the mean number of error frames for all Ss was 329.22 which gave a mean error rate of 8 percent. There was then a large drop in the error rate when the number of repeated errors was isolated from total errors, and considered separately. In other words, only a very small percentage(.008) of the mean number of error frames consisted of repeated errors.

The 11 Ss who had 9 or more repeated errors(approximately one standard deviation above the mean of 4.32) were selected for the purpose of analyzing their learner characteristics. The 11 constituted only 15 percent of the total N, and the frequency of 9 used as the cut-off point was still less than 2 percent of the mean number of error frames(329.22). Further, the 11 Ss selected showed no consistent pattern of learner characteristics.

It can be seen from these results that repeated errors contributed very little to the number of error frames. It does seem that knowledge of results was very effective in extinguishing wrong responses in the programed course employed in this study. Further, the relationship between error rate and learning ability found in the original study was not reflected in the results of this study.

These results tend to confirm, in terms of the frequency of repeated errors, the findings of Ripple(1963) and Lublin(1965) in which they demonstrated the importance of knowledge of results. They also are consistent with Moore and Smith's(1964) results in which knowledge of the correct response was seen to be effective.

In the program utilized in this study, knowledge of results was provided in the form of the correct response located in the left half of a space just below each frame. A cut-out mask was used to cover the correct response while the learner's response was being constructed on the right half of the space. This method afforded very little control over (a) peeking at the correct response before constructing it, or (b) paying attention to the correct response after the response was made. In view of this lack of control over these contingencies, the findings of this study relative to the effectiveness of knowledge of results in extinguishing incorrect responses cannot be considered conclusive. On the other hand, there was no indication in this study that much peeking actually took place.

Markle(1964) suggested two situations when knowledge of results would be needed in instruction: (a) when a learner is certain that his answer is correct, but in fact it is incorrect, and (b) when a learner is correct but is uncertain that he is. A third situation could be added to the above; that is, when a learner is uncertain about the correctness of his response, and is, in fact, incorrect. Where the method of providing knowledge of results leaves so much under the control of the learner himself as it did in this study, when a learner is certain about his answer when he is actually wrong, he is likely not to pay attention to the feedback. This, however, did not seem to be a problem in this study. On the other hand, it is reasonable to assume that it is when a learner is uncertain about his answer that he is most likely to peek at the correct answer provided before making his own response. This would reduce the possibility that he would make an erroneous response that would need to be extinguished. Although it is possible that the low rate of repeated errors obtained in this study was due to "peeking" of this sort, there are no data available to indicate this.

Prompting Techniques

When the number of errors made on formal and thematic prompt frames were related to learner characteristics, there were very few statistically significant correlations found for the two groups of students who worked their programs during the regular classroom periods. The significant r's found for these two groups probably could be regarded as chance factors in operation. However, in the two groups who worked their programs in the more independent situation outside of the classroom, there were a number of statistically significant correlations found. When the more traditional ability measures were used, both the group that worked on self-determined schedules and the one that worked on a teacher-determined schedule showed significant negative r's. When the creativity measures were used, the most independent group(out-of-class and self-determined) schedules showed a number of significant negative r's.

These findings might be easily predicted in terms of the more able students would be expected to make fewer errors, regardless of the prompt technique used. However, the remainder of the findings might not be as easily predicted, especially those involving the creativity measures.

When the ability measures are correlated with formal prompt frames and then with thematic prompt ones, it is shown that there tends to be fewer errors made on the formal prompt frames. This is true for both the self-determined and teacher-determined scheduled groups. However, for the most independent group(out-of-class and self-determined schedules) the tendency is for fewer errors on the thematic prompt frames. It would seem that the more creative student, when in a situation of much independence, works harder on the frames that do not have the correct responses embedded in them. This may be because the formal prompts are not as "challenging" and do not receive as much attention. Whatever the mechanism involved, these consistent data should have some pragmatic significance if one is trying to fit a program to the individual student.

Incidence of Boredom Symptoms

Accepted as boredom symptoms were (a) attempts to shorten responses, e.g. use of ditto marks, initials, omitted words in multiple word responses, circled answers, and failure to write a given response the required number of times; (b) deteriorating handwriting, and (c) blocks of 5 frames omitted in succession.

The mean number of frames containing boredom symptoms was 40.68. This was barely .006 percent of the total of 7052 frames in the programed course. Even the frequency of 113(one standard deviation above the mean) was only .002 percent of the total frames. The 6 Ss who had frequencies of 113, or over, was only 9 percent of all the Ss. Further, these 6 Ss showed no consistent pattern of learner characteristics. It was seen, however, that 5 of these 6 Ss were members of the groups who worked on the program in class.

A measure of the incidence of boredom by quarters was taken. A significant Chi-square was obtained indicating that there was a significant trend toward increasing frequencies of boredom symptoms in the later quarters, especially in the third quarter. Frequencies by quarters were obtained for the same 6 Ss above who had 113 or more boredom symptoms to see whether they would also show the same tendency toward increasing frequencies in the later quarters. They tended to follow the pattern of the group. It must be remembered, nevertheless, that these frequencies were all still very small.

These results indicate that boredom, as evidenced by the particular symptoms considered, was far from a serious problem. There appears to be an inconsistency here with Gotkin(1963) and Thelan and Ginther(1964) who reported that learners frequently complain of being bored by programed instruction. There appears also to be an inconsistency with those who have reported that boredom is caused by the inherent characteristics of linear programs, i.e., Van Atta(1961) who claimed that repetition and too short steps caused boredom, and Mager (1961) who held that motivation was a function of the degree of control a learner has over his own instruction.

These inconsistencies, however, may be more apparent than real. Understanding that there frequently is a period of build up of covert feelings of boredom before overt expressions are made, and taking into consideration that there was a significant trend toward increasing frequencies over time, it could be hypothesized that there was a latency factor operating here; that is, the incidence of boredom symptoms might have been much higher had the programed course been longer and/or the experiment extended over a longer period of time. This hypothesis is supported somewhat by the fact that, in the original study, a significant drop in favorable attitude toward programed instruction and a significant drop in achievement was noted in the second semester(Woodruff, Shimabukuro, & Frey, 1965). However, remembering that this study took place over an entire school year, this hypothesizing is more rhetorical than practical. Ordinarily programs would not be used over a longer period of time without some extended "rest interval," such as summer vacation.

Another consideration is the fact that this study accounted for boredom as measured by the frequency of boredom symptoms actually appearing in the completed programs. There are other symptoms of boredom that are never recorded permanently, e.g. daydreaming, looking out the window, "horsing around," dozing, etc. It is possible that had measures of such symptoms been available, boredom would have been found to be a problem.

On the other hand, the increasing frequency of boredom symptoms in the later quarters might have been caused by factors other than time. For example, it could have been a function of the nature of the subject matter, or the difficulty level of the treatment of the material. Moreover, programed instruction research is focused on overt responses to specific stimuli--on what the learner actually does in response to particular frames. On this basis, it is stated that boredom was not found to be a serious problem in this study.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

Problem and Procedures

This study was an extension of the Cooperative Research Project No. 2284 in which methods of program use was related to learner characteristics. In this extension, new hypotheses growing out of the original data analysis were investigated.

The hypotheses were stated in terms of sub-problems as follows:

1. Is there significant variability in the effect of immediate knowledge of results when related to individual differences in learner characteristics?
2. Are there significant differences in the effectiveness of various prompting techniques when related to individual differences in learner characteristics?
3. Are there significant differences in the incidence of boredom symptoms when related to differences in learner characteristics?

The original programs containing the Ss frame by frame responses were re-examined to provide the measures needed to test the null hypotheses implied in each of these sub-problems.

Results

Sub-problem #1. The effect of knowledge of results with respect to the extinguishing of incorrect responses was the object of this analysis. The measure was frequencies of wrong responses that were repeated one or more times.

The frequencies obtained were so extremely small that it made correlational analysis meaningless. The mean number of repeated errors was 4.32 with a standard deviation of 4.96. In relating this measure to learner characteristics, Ss were selected who had repeated errors of 9 or more. The Ss so selected showed no consistent pattern of learner characteristics.

Sub-problem #2. In this analysis an attempt was made to see if the learner characteristics were related to the effectiveness of formal prompt or thematic prompt techniques.

It was found that there were meaningful relationships here in situations where the student was working the program on his own(out-side of class). It was found that those who were higher in the more common ability measures (working on his own) made fewer errors on the formal prompt frames. The situation where creativity measures were significantly related was under conditions of greatest independence(out-of-class and self-determined schedule). The group working under these conditions made fewer errors under the thematic prompt technique.

Sub-problem #3. The number of frames containing boredom symptoms were tabulated for each S. The mean number of such frames was 40.68 with a standard deviation of 72.32. This was a mean rate of only .006 percent(of the total of 7052 frames), and indicated a drastically skewed distribution of scores. Correlational analysis, therefore, was not deemed to be justified.

Ss were selected who had frequencies of boredom symptoms of 113 or more(one standard deviation above the mean). They showed no consistent pattern of learner characteristics.

CONCLUSIONS

The larger and more basic issue to which this study was addressed was: "Does programed instruction provide adequately for individual differences among learners?" This problem was pursued in this study on the basis of four measures: (a) frequency of repeated errors; (b) frequency of high error frames classified as to type of prompt utilized in it--formal or thematic; (c) frequency of boredom symptoms, and (d) frequency of boredom symptoms in each of the four quarters of the programed course.

Of these four measures, only one, frequency of error frames classified as to type of prompt utilized was found to be significantly related to learner characteristics. Those who were higher in common learning abilities measures, working on the programs outside of class, made fewer errors on the formal type prompts. Those who were high in creativity measures, working on the programs outside of class and at their individual rates, made fewer errors on thematic type prompts.

The frequency of repeated errors was assumed to be a measure of the effectiveness of knowledge of results in extinguishing incorrect responses. The frequencies were extremely low and an examination of the characteristics of Ss who scored high on this measure revealed no consistent pattern of learner characteristics. The apparent conclusion to be drawn from these results is that knowledge of results, as provided in the program utilized, is effective in extinguishing incorrect responses, and that its effectiveness is not influenced by the learner characteristics considered in this study.

The incidence of boredom was likewise extremely low, and the Ss having the highest frequencies of boredom symptoms showed no pattern of learner characteristics. In relation to learner characteristics, nothing significant was found in the incidence of boredom symptoms over time. It is concluded, therefore, that boredom was not a major problem, and that its incidence is not related to learner characteristics.

RECOMMENDATIONS

It was hoped that this study would provide some insights into the adaptability of linear programs to learners with different characteristics. Indeed, the findings of this study do seem to indicate that the following suggestins regarding the construction and utilization of linear programs would be advisable:

1. Program construction. The continued use of knowledge of results which provide the correct answer is indicated. Initial errors produced by a learner because the step at that point was too large for him, or because he did not have the initial behaviours to successfully cope with the frame, appear to be effectively corrected by this feedback technique.

The type and strength of prompt to use in a frame should be considered a critical issue. Neither formal nor thematic prompts by themselves overcome the influence of learning ability on error rate in programed instruction. The control of step size through the use of prompts is likely to be the key factor in the adaptation of programed instruction to differences in learning ability. The impression that a frame with formal prompts is easier than a frame with thematic prompts is likely to be more apparent than real.

The obvious use of vanishing should be avoided. The systematic tabulation of boredom symptoms and repeated errors in relation to vanishing was not made in this study. However, it appeared to the researchers that sequences of frames in which the verbatim memorization of definitions, or statements of principles and generalizations, was being taught through the vanishing technique in which a few additional words are removed in each subsequent frame until all significant words are removed in the final frame in the sequence, produced more boredom symptoms than other frames. In this connection, frames which simply instructed the learner to write a word several times so that its spelling could be mastered seemed also to produce more signs of boredom. Such obvious and meaningless requests for the repetition of responses should be discouraged. Responses need to be repeated in order to be strengthened, but this should be done through subtle and interesting variations of stimuli.

2. Program utilization. The original study indicated that achievement and performance were significantly related to learning ability. In this study, it was found that the effectiveness of formal and thematic prompts were significantly related to learning ability, but that this relationship was established by the groups who worked on the programs outside of classroom situations in the absence

of direct supervision from the teacher. These two studies provide a complement of results which indicate that only the higher ability students should be permitted to work on programs in out-of-class situations. Lower ability, and poorly motivated, learners should work on programs in in-class and more closely supervised situations. The creativity measures were found to be significant only in the one instance--among the group in out-of-class and self-directed situations, and only in relation to the effectiveness of formal and thematic prompts. It would appear that the freest instructional situations in which learners are given maximum opportunity to direct their own work on programs should be reserved for high ability learners who are also the most creative.

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Appendix A

Summary of Scores of All Subjects On All Measures

SOUND

Unit	Formal	Thematic
1		12
2		53
3		3,8,15,24
4		13
6		11,12
9		2
10		9
11	30,37	

LIGHT

Unit	Formal	Thematic
1		8
2		33
3	48	36,39,41,45
4	39	69,74
5	31	39,59,61
6	43	18

ELECTRICITY

Unit	Formal	Thematic
1		10,62,143
3		89

COMMUNICATIONS

Unit	Formal	Thematic
1		36
2		15,23
3	59	50,60,61
4		7,20,58,73
5	120,126,135,141,161 162,170,174	73,93,152,155,156,160,163,164,165 166,167,169,171,172,173

MEASUREMENT

Unit	Formal	Thematic
1		1
3	25,52	66,67,70,80,75,91,92
4		3
5		8,9,11,14
6	7,8	10,22
7		25
8	1,26	2,3,4,5,6,7,8,20,24,25,32,35,36

METEOROLOGY

2	59	10,50
3		19
5	71	19,34
8	32,47,62	4,8,45,63,70,79,86,101,113
9	7,37,38,45,67,72,73	2,4,13,14,23,28,29,32,42,43,44,56,57
10	37,62,64,66,68,80,94	4,6,27,61,70,71,72,79,86,87,106
11	8,25,68,75	60,74,80
12	4,44	51

ASTRONOMY

1		73
3	18,75	11,113,115,125
4		59,102
5		98
6		34,39
7		43,61,79,80,86,87,88,89,90
8	22	54,72
9	19	27,35

WORK AND MACHINES

1	143,145	26,27,101,110,132,135,144,155,174 184,188,201
2	17,45,47	12,32,33,35
3	6,11,47	14,32,43,55,65,69,70,75
4	80,100	17,20,21,36,40,41,42,45,51,59,68,84
5	22,23,91,95,97	9,38,69,72,76,77,79,112,117,133,135 136,139,140,141,142,146,148,149,150 151,152,153,154
6	8	16,22,34,37,50,57,65,68,70,71,74,75 76,79,85,87,88,89,96,97,101,103
7	65,100,110,120,126,178 181,185,186,192,210	33,129,140,142,146,162,163,189,206,215
8	10	
9	9	2,14,21,29,42,43,47,48,50,67,68,70,74, 75,79,80
10	15,28,123,125,155,156	1,27,30,36,48,50,51,61,62,73,86,87,94 95,100,103,110,114,121,126,129,130,135 136,137,139,140,143,145,150,152,153,157

BIOLOGY

1	38,72,91,106,112,113 115,143	10,28,33,46,48,53,54,59,68,76,95,97 102,122,123,139,144,148
2	18,19	3,14
3	6	10,16,17,18,19,22,23
4	12,15	6,34,43,65,70
6	5	
7	30,43,101,119,124,128, 138,143	18,19,36,97,112,117
9	61,78	56,72,92,98
10	81,94,106	37,63,65,70,73,79.80.83,90,101,103
11	82,96,132,133,187	29,57,58,63,164,175,177,189,203,204 211,213
12		8
13	68,103	33,37,69,72,78,81,82,85,87,89,93,100 101,105,114,115
14	18,94	32,34,35,36,38,40,48,49,62,64,70,73,75 81,83,82,85,88,89,93

CHEMISTRY

1		7,25,95
2	29	
3	14,17,19	
4	52,59,60,61	35,54,62
5		17,25,27,30,45,53,67
6	7	17
8		20,42,48
9		27
10	28,39	20,21,29,37,40,48,49
11		39,54,55,60,61
12	20,36	19,30,35,37,38,39,40
13	8,34,45,51,86,87,90	57,59,60,77,79,85,93,95
14		4,18,31,43,44
15	49	37,44,56

Appendix B

Classification of High Error Frames into Formal or Thematic Prompt Techniques

NOTE: On the tables in Appendix B, the key to variable identification is as follows:

Variable Name	Variable No.
CREATIVITY MEASURES	
Circles, Fluency	1
" , Flexibility	2
" , Originality	3
" , Elaboration	4
" , Total	5
Improvements, Fluency	6
" , Flexibility	7
" , Origniality	8
" , Elaboration	9
" , Total	10
Tin Cans, Fluency	11
" , Flexibility	12
" , Originality	13
" , Elaboration	14
" , Total	15
Consequences 1, Fluency	16
" , Originality	17
" , Total	18
Consequences 2, Fluency	19
" , Originality	20
" , Total	21

Variable Name	Variable No.
LEARNING ABILITY MEASURES	
Grade Average, All subjects (One decimal place)	22
" " , Science (One decimal place)	23
Gates Reading, Speed	24
" " , Vocabulary	25
" " , Comprehension	26
" " , Total	27
Lorge-Thorndike, Verbal Raw Score	28
" " , Verbal I.Q.	29
" " , Nonverbal Raw Score	30
" " , Nonverbal I.Q.	31
ERRORS IN FRAMES	
Formal prompt total	32
Thematic prompt total	33
BOREDOM SYMPTOMS	
Ditto marks	34
Abbreviations	35
Wrote only numbers	36
No answer - line drawn	37
Failure to write words five (5) times	38
Poor handwriting	39
Omitions	40
Doodles	41

GROUP I

VARIABLE NUMBER

S NO.	1	2	3	4	5	6	7	8	9	10	11	12	16	14	15	16	17	18	19	20	21
101	16	15	16	15	62	5	3	3	0	11	4	3	0	1	8	1	0	1	2	0	2
102	20	16	10	6	52	11	6	9	0	26	5	3	3	0	11	3	3	6	1	0	1
103	9	3	0	11	23	7	2	6	2	17	4	3	5	1	13	4	4	8	2	1	3
104	15	15	18	33	81	3	3	0	0	6	5	5	4	2	12	2	1	3	3	2	5
105	9	6	2	17	34	15	5	13	4	37	5	4	5	2	16	3	4	7	2	2	4
106	25	19	17	12	73	14	3	9	0	26	5	4	2	1	12	4	6	10	3	2	5
107	5	4	2	6	17	5	4	0	1	10	2	2	4	0	8	1	1	2	1	0	1
108	12	8	12	49	81	7	6	4	2	19	5	3	3	0	11	5	3	8	3	2	5
109	9	8	1	14	32	5	3	4	2	14	2	3	1	2	8	0	0	0	1	0	1
110	18	15	14	35	82	16	6	9	0	31	12	8	10	1	31	3	5	8	3	3	6
111	5	5	0	13	23	10	6	9	0	25	2	2	2	0	6	1	0	1	1	3	4
112	9	5	8	32	54	9	2	6	0	17	7	5	7	0	19	1	5	6	1	3	4
113	13	11	5	22	51	24	9	21	0	54	9	7	4	0	20	4	8	12	3	4	7
114	6	5	5	23	39	5	2	4	0	11	7	6	10	0	23	3	4	7	3	2	5
115	11	9	1	19	40	15	6	10	0	31	5	4	8	0	17	2	3	5	4	3	7

GROUP I

VARIABLE NUMBER

S NO	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
101	31	30	26	41	30	81	52	105	46	102	3	33	0	0	0	0	0	0	0	0
102	19	15	19	30	29	76	36	92	23	80	25	87	0	0	0	0	0	59	1	2
103	20	20	13	36	33	82	39	99	48	105	7	17	0	0	0	0	1	0	0	0
104	27	25	21	39	29	77	49	106	42	100	21	59	1	0	0	0	0	0	4	0
105	40	40	24	49	37	92	61	114	64	128	28	87	1	85	0	0	29	10	0	11
106	36	30	26	41	37	84	50	106	64	130	27	164	1	0	0	0	0	0	0	0
107	22	20	16	33	28	71	40	98	50	110	60	174	8	36	31	0	31	39	1	6
108	33	30	23	55	38	93	68	126	53	114	13	86	5	1	0	0	0	0	1	0
109	23	25	16	34	23	68	38	93	35	91	20	58	0	0	0	0	0	0	2	0
110	21	20	21	40	31	78	44	101	39	96	16	115	0	0	0	0	0	0	0	0
111	35	35	20	39	33	79	60	116	55	116	31	167	4	0	0	6	0	0	2	0
112	11	15	15	30	19	64	32	89	36	104	12	45	0	0	0	0	0	0	3	0
113	33	35	22	28	26	68	48	102	51	109	26	93	3	1	0	0	0	0	0	21
114	33	35	18	33	34	75	58	115	49	108	45	189	0	0	0	0	1	0	3	0
115	23	25	18	35	29	74	42	100	43	101	9	47	0	3	0	0	3	45	1	1

GROUP II

VARIABLE NUMBER

S NO.	1	2	3	4	5	6	7	8	9	10	11	12	16	14	15	16	17	18	19	20	21
201	7	5	5	28	45	14	5	12	0	31	6	4	6	2	18	3	4	7	2	1	3
202	11	8	14	54	87	9	7	5	2	23	4	3	4	0	11	4	8	12	4	6	10
203	9	6	2	27	44	14	5	13	1	33	6	4	0	0	10	2	1	3	1	0	1
204	9	6	6	30	51	4	3	0	0	7	9	2	2	0	13	2	4	6	4	1	5
205	16	13	11	36	76	14	8	5	0	27	13	3	1	0	17	3	2	5	3	3	6
206	6	4	7	34	51	6	3	5	0	14	9	8	12	0	29	1	1	2	1	0	1
207	21	17	16	27	81	13	4	11	1	29	2	2	2	1	7	3	4	87	2	1	3
208	19	6	6	43	74	16	7	13	2	38	11	5	6	2	24	3	3	6	1	2	3
209	16	10	14	46	86	6	3	3	0	12	6	5	5	0	16	3	3	6	2	2	4
210	11	10	7	29	57	11	2	10	0	23	3	3	3	0	9	1	1	2	1	0	1
211	9	8	5	28	50	7	3	2	0	12	5	5	1	0	11	2	1	3	2	4	6
212	9	5	8	47	69	14	3	13	0	30	9	6	10	0	25	2	0	2	1	0	1
213	12	12	8	22	54	9	5	4	1	19	6	2	1	0	9	2	0	4	1	0	1
214	9	8	4	21	42	4	2	1	0	7	1	1	0	0	2	2	2	4	1	1	2
215	14	8	1	30	53	19	5	7	12	43	10	5	6	0	21	3	8	11	1	5	6
216	6	6	3	13	28	5	3	8	0	16	8	3	0	1	12	2	1	3	1	1	2
217	10	9	4	22	45	8	6	5	0	19	2	2	0	0	4	2	2	4	2	1	3
218	1	1	2	5	9	8	3	7	2	20	1	1	0	0	2	2	2	4	2	1	3
219	7	7	6	14	34	7	5	3	0	15	7	5	7	1	20	4	4	8	3	3	6
220	11	7	11	37	66	11	6	9	0	26	2	2	3	1	8	3	1	4	1	0	1
221	11	8	13	34	66	7	5	13	9	34	9	5	12	0	26	2	2	4	1	3	4
222	9	9	2	13	33	9	5	4	0	18	3	3	0	0	6	2	1	3	1	4	5
223	12	9	9	24	54	12	5	11	1	29	10	8	11	1	30	3	4	7	3	3	6
224	9	7	7	41	64	11	4	11	0	26	6	6	5	0	17	5	4	9	3	3	6
225	14	11	7	34	66	10	3	5	2	20	2	2	0	0	4	3	3	6	2	0	2

GROUP II

VARIABLE NUMBER

S NO	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
201	32	40	28	34	34	77	69	123	61	123	25	97	1	5	0	0	8	14	0	6
202	31	35	24	46	29	85	60	113	47	103	48	157	34	0	0	0	11	12	6	6
203	24	25	18	44	33	83	50	107	48	107	40	140	0	1	0	17	16	29	12	0
204	32	35	21	43	33	85	54	108	59	121	34	94	18	9	10	5	9	0	6	1
205	18	15	17	24	22	60	46	95	41	117	37	143	0	0	0	0	8	0	3	0
206	17	20	14	34	27	83	50	103	50	107	45	133	9	0	0	4	27	40	144	10
207	23	20	19	33	31	74	47	101	49	106	38	135	0	0	0	0	0	3	2	0
208	26	30	20	38	34	82	52	105	57	117	20	58	0	0	0	0	19	0	2	0
209	21	20	12	26	23	87	32	90	46	105	30	81	0	1	0	0	8	7	1	0
210	25	25	15	23	29	76	38	97	47	107	74	224	12	89	13	119	28	87	18	9
211	40	40	28	47	37	88	62	118	64	130	10	40	2	0	0	0	0	0	0	0
212	24	25	20	36	32	74	50	107	53	114	12	44	7	0	0	0	0	0	1	0
213	33	30	21	34	36	76	60	113	49	105	37	98	5	29	10	0	30	0	0	5
214	35	35	19	49	39	94	68	125	61	125	19	38	2	0	0	0	10	23	3	1
215	19	20	17	45	23	94	44	102	44	102	74	242	0	0	0	0	1	2	5	0
216	20	20	14	24	28	65	34	85	19	71	66	255	0	0	0	4	0	0	3	0
217	26	25	21	36	28	75	42	97	42	98	19	29	9	0	0	0	3	0	11	1
218	28	35	19	41	36	92	74	137	47	107	34	120	0	1	0	0	2	4	3	0
219	24	30	15	32	36	85	45	101	64	130	47	192	0	0	0	0	0	75	1	0
220	23	30	11	22	27	74	39	94	50	108	45	148	11	3	2	0	3	186	12	8
221	37	40	15	52	32	90	61	114	56	115	33	129	5	0	0	0	1	1	0	0
222	23	30	16	34	26	71	42	99	50	109	11	35	1	0	0	0	0	0	1	0
223	39	40	20	48	36	86	70	125	58	118	26	151	0	20	0	0	0	0	1	0
224	33	30	19	30	37	75	48	102	55	115	41	213	6	0	0	0	0	3	1	0
225	29	25	26	34	36	78	37	93	51	109	18	60	8	0	0	0	3	0	2	0

GROUP III

VARIABLE NUMBER

S NO.	1	2	3	4	5	6	7	8	9	10	11	12	16	14	15	16	17	18	19	20	21
301	14	5	6	32	57	10	7	7	0	24	5	2	0	3	10	4	3	7	2	2	4
302	6	5	4	16	31	10	3	6	1	20	5	5	4	1	15	2	1	3	1	2	3
303	14	12	3	26	55	10	4	5	4	23	3	2	0	4	9	3	4	7	2	3	5
304	27	21	19	51	118	12	6	8	2	28	6	4	4	1	15	4	5	9	3	5	8
305	22	18	17	60	117	18	9	13	0	40	26	12	23	2	53	6	9	15	3	1	4
306	31	10	25	91	157	12	5	4	2	23	7	6	4	0	17	1	3	4	2	1	3
307	19	13	13	35	80	8	4	3	0	15	4	1	0	0	5	2	1	3	2	4	6
308	10	9	12	38	69	14	4	9	0	27	6	4	7	1	18	3	5	8	2	3	5
309	20	15	10	44	89	18	8	19	2	47	8	3	1	4	16	3	5	8	3	2	5
310	20	12	14	21	67	17	5	16	0	38	14	8	13	0	35	2	2	4	1	0	1
311	5	5	3	19	32	10	5	6	0	21	3	3	2	5	13	3	3	6	1	2	3
312	17	7	4	39	61	8	5	6	2	21	7	5	10	0	22	0	0	0	1	0	1
313	9	7	3	32	51	10	4	11	0	25	7	2	6	0	15	3	2	5	2	0	2
314	11	7	4	33	55	8	7	4	4	23	1	1	0	7	9	3	4	7	2	2	4
315	11	7	7	20	45	14	6	14	0	34	6	4	4	0	14	2	3	5	2	0	2
317	12	9	5	27	53	12	5	6	1	24	7	6	2	1	16	2	0	2	2	3	5

GROUP III

VARIABLE NUMBER

S NO	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
301	15	10	14	31	24	67	41	99	51	111	30	110	4	0	0	0	1	0	150	0
302	22	20	13	18	13	45	45	96	41	97	58	208	12	17	0	0	0	0	4	3
303	35	30	30	49	37	89	69	126	61	125	20	129	0	0	0	0	0	0	20	0
304	37	35	24	41	31	80	50	107	45	104	24	65	0	0	0	0	0	0	0	0
305	28	30	21	28	31	71	63	119	62	127	15	22	2	0	0	0	0	52	5	0
306	28	25	23	32	31	76	48	104	38	95	32	132	0	0	0	0	0	5	6	0
307	25	25	12	27	23	62	35	86	25	79	72	214	0	13	0	0	0	44	10	0
308	37	35	24	43	35	88	61	117	63	129	5	29	0	0	0	0	0	0	1	0
309	40	40	27	39	36	82	59	112	60	122	5	42	0	0	0	0	0	0	3	0
310	16	15	18	27	18	62	32	88	47	104	21	82	0	0	0	0	0	0	2	0
311	40	40	28	54	38	98	71	130	61	126	16	93	0	0	0	0	0	0	0	0
312	11	10	11	16	11	60	23	76	25	80	79	253	0	0	0	0	0	0	3	4
313	24	20	29	45	34	86	63	119	50	109	11	63	6	1	0	0	0	0	4	0
314	22	20	24	16	32	80	51	108	27	121	12	74	0	0	0	0	0	0	6	0
315	28	30	20	40	36	82	47	100	50	107	19	82	0	0	0	0	0	0	20	0
317	16	20	15	27	28	66	39	97	38	96	73	228	0	0	0	0	0	0	1	0

GROUP IV

VARIABLE NUMBER

S NO.	1	2	3	4	5	6	7	8	9	10	11	12	16	14	15	16	17	18	19	20	21
401	14	14	8	24	60	13	6	10	1	30	5	3	8	6	22	3	3	6	1	0	1
404	25	8	9	10	52	18	6	14	1	39	5	4	9	0	18	2	0	2	1	2	3
405	8	7	1	16	32	13	4	11	0	28	6	5	6	0	17	1	4	5	4	6	10
406	10	9	11	16	46	10	5	9	4	28	4	3	4	2	13	3	3	6	2	1	3
407	16	15	7	15	53	15	7	9	0	31	8	4	6	0	18	3	1	4	3	3	6
408	21	17	15	27	80	18	6	25	0	49	11	6	19	0	36	4	5	9	4	8	12
409	5	5	4	7	21	10	2	11	6	29	5	4	6	2	17	2	3	5	3	3	6
410	14	13	19	12	58	13	5	12	7	37	7	4	3	7	21	4	5	9	3	1	4
411	9	8	3	9	29	10	3	8	0	21	4	4	8	1	17	2	2	1	1	2	3
412	15	13	12	16	56	9	4	5	0	18	5	3	0	0	8	3	2	5	1	1	2
413	9	8	6	8	31	8	2	5	0	15	8	4	2	7	21	3	3	6	4	1	5
414	15	13	12	16	56	8	4	5	1	18	5	3	0	1	9	2	3	5	1	0	1
415	1	1	0	2	4	13	6	12	2	33	7	5	4	0	16	3	3	6	1	3	4
416	14	13	9	19	55	6	5	2	0	13	4	3	6	0	13	4	4	8	2	0	2
418	9	9	2	9	29	5	3	3	1	12	5	5	3	1	14	3	5	8	1	1	2
419	11	8	3	5	27	16	6	20	0	42	7	6	3	0	16	3	4	7	5	3	8
420	12	9	1	12	34	11	4	7	1	23	11	6	16	0	33	3	4	7	2	2	1
422	13	12	7	8	40	10	3	9	0	22	6	4	4	1	15	4	2	6	2	1	3

GROUP IV

VARIABLE NUMBER

S NO	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
401	31	30	19	30	33	74	51	107	49	107	18	105	0	1	0	0	0	0	0	0
404	18	15	20	23	21	60	36	93	48	106	43	110	16	1	0	0	0	5	42	0
405	24	20	24	38	27	76	42	100	52	112	22	86	4	0	0	10	6	0	0	0
406	40	40	23	50	41	92	69	129	65	134	10	71	0	0	0	0	0	0	1	0
407	23	25	13	26	32	68	43	97	55	114	21	108	0	1	0	0	1	0	15	0
408	39	40	30	54	39	94	80	139	61	121	15	44	10	76	3	0	0	17	3	1
409	23	30	27	44	34	90	59	115	53	113	38	114	4	0	0	0	0	0	21	0
410	36	40	30	53	41	94	66	123	45	103	31	136	0	0	1	0	0	0	4	0
411	8	5	10	9	0	27	25	77	36	89	73	204	15	5	0	0	32	4	59	0
412	34	25	23	43	32	84	60	114	51	109	9	35	0	0	0	0	0	0	0	0
413	33	30	25	39	27	77	59	113	49	106	28	136	0	0	0	0	0	0	0	0
414	39	35	27	48	32	84	60	116	52	111	11	52	4	0	0	0	0	0	0	0
415	28	25	18	34	31	74	52	106	49	106	3	14	0	0	0	0	0	0	2	0
416	26	25	18	39	19	62	57	110	53	111	30	109	0	9	0	0	4	0	6	0
418	22	15	23	34	29	73	37	89	46	99	45	95	6	2	1	0	0	0	11	0
419	28	20	20	43	33	83	54	104	47	101	59	97	1	0	0	0	0	0	2	0
420	10	10	13	31	26	73	35	93	47	106	65	231	0	0	0	0	1	0	43	0
422	24	20	20	34	31	75	45	102	49	108	44	161	0	0	0	0	8	0	0	2